

## Abstracts of Technical Articles from Bell System Sources

*Radio Telephone System for Harbor and Coastal Services.*<sup>1</sup> C. N. ANDERSON and H. M. PRUDEN. Radio telephone service with harbor and coastal vessels is now being given through coastal stations in the vicinities of seven large harbors on the Atlantic and Pacific coasts with additional stations planned. The system is designed to be as simple as possible from both the technical and operating standpoints on both ship and shore.

Recent developments in the shore-station design eliminates all manipulations of the controls by the technical operator. This is made possible principally because of crystal-controlled frequencies on shore and ship, a "vogad" which keeps the transmitting volume of the shore subscriber constant, and a "codan" incorporated in the shore radio receiver which will operate on signal carrier but is highly discriminatory against noise. A signaling system permits the traffic operator to call in an individual boat by dialing the assigned code which rings a bell on the particular boat called. The ship calls the shore station by turning on the transmitter. The radio signal operates the codan in the shore receiver which in turn lights a signal lamp in the traffic switchboard.

Gradually the system has been taking on more and more the aspects of the wire telephone system.

*Ship Equipment for Harbor and Coastal Radio Telephone Service.*<sup>2</sup> R. S. BAIR. The ultimate objective in the design of radio telephone apparatus for use on ships is to provide equipment which is as convenient and simple to operate as the telephone at home. To a considerable degree this has been accomplished in the new 15- and 50-watt ship sets that have recently been designed for use on harbor craft and coastwise vessels.

The requirements for sets of this type are discussed and the new equipment is described in this paper.

*Protective Coatings for Metals.*<sup>3</sup> R. M. BURNS and A. E. SCHUH. This book is one of the American Chemical Society Series of Scientific and Technologic Monographs. The chapter headings are: *Protective*

<sup>1</sup> *Proc. I. R. E.*, April 1939.

<sup>2</sup> *Proc. I. R. E.*, April 1939.

<sup>3</sup> Published by Reinhold Publishing Corporation, New York, N. Y., 1939.

*Coatings and the Mechanism of Corrosion—Surface Preparation for the Application of Coatings—Types of Metallic Coatings and Methods of Application—Zinc Coating by Hot-Dipping Process—Zinc Coating by Electroplating and Cementation—Protective Value of Zinc Coatings—Cadmium Coatings and their Protective Value—Tin Coatings—Nickel and Chromium Coatings—Coatings of Copper, Lead, Aluminum and Miscellaneous Metals—Coatings of Noble and Rare Metals—Methods of Testing Metallic Coatings—Composition of Paints and Mechanism of Film Formation—The Durability and Evaluation of Paints—Paint Practices—Miscellaneous Coatings.*

"The active interest manifested during the past few years in investigations on the general subject of the corrosion of metals has led to the carrying-out of long-time exposure tests which yielded much new basic information having a direct bearing on our knowledge of the useful life of coatings and coated metals. The authors have wisely incorporated a great deal of this information in the discussion of the different types of coatings. Likewise, it has been deemed desirable to devote considerable space to the preliminary preparation of metal surfaces before the application of the coating since the quality of any coating is so dependent upon this factor.

"The new monograph, therefore, covers a much broader field than did the previous one which was really a pioneer in the field of metallic coatings. The investigator of the abstruse problems of corrosion as well as the materials engineer seeking practical help in combating this problem by preventing corrosion by protecting the surface will find this volume a veritable mine of information on all phases of the subject."

*A Synthetic Speaker.*<sup>4</sup> HOMER DUDLEY, R. R. RIESZ, and S. S. A. WATKINS. This synthetic speaker is an electrical device manipulated by keys and levers for the production of synthetic vocal sounds and their combination into speech. The device was developed as an interesting educational exhibit by the Bell System at the San Francisco Exposition and the New York World's Fair.

From a buzzer-like tone and a hissing noise as raw material, the operator skillfully shapes speech by manipulating the controls to give inflection and the sound spectrum that differentiates one speech sound from another.

This paper covers the development of the device and the training of the operators to demonstrate it.

<sup>4</sup> *Jour. Franklin Institute*, June 1939.

*Remotely Controlled Receiver for Radio Telephone Systems.*<sup>5</sup> H. B. FISCHER. New radio receiving equipment for shore station used in ship-to-shore telephone circuits has been developed. This equipment is designed to operate on a remotely attended basis and may be located a considerable distance from the telephone terminal equipment. The radio receiver forming a part of the equipment has a codan circuit which operates reliably under high noise conditions and does not require adjustments to compensate for variations in the noise level. An emergency battery power-supply system is provided which is automatically connected to the receiver when the primary alternating-current power supply fails. Power failures are indicated at the telephone central office. A test oscillator which is controlled from the telephone central office is provided which may be used to check the operation of the receiver or to measure the frequency deviations of the incoming signals. The various apparatus units are mounted in two weather-proof cabinets which may be fastened to the same telephone pole which supports the receiving antenna.

*Analysis and Measurement of Distortion in Variable-Density Recording.*<sup>6</sup> J. G. FRAYNE and R. R. SCOVILLE. Several types of non-linear distortion in variable-density recording are discussed and methods of measurement outlined. The two-frequency inter-modulation method is described. Mathematical and experimental relationships between per cent inter-modulation and per cent harmonic distortion are established. The inter-modulation method is applied to film processing for the determination of optimal negative and positive densities and overall gamma. Variance of these parameters from those indicated by classical sensitometry are traced to halation in the emulsion and to processing irregularities. The use of special anti-halation emulsions appear to reduce residual distortion effects and tend to bridge the gap between inter-modulation and sensitometric control values.

*Rubbed Films of Barium Stearate and Stearic Acid.*<sup>7</sup> L. H. GERMER and K. H. STORKS. Films of barium stearate and of stearic acid have been prepared on polished chromium and on smooth natural faces of silicon carbide crystals. After these films have been rubbed with clean lens paper, electron diffraction patterns are obtained from them by the reflection method. *Well rubbed films* give patterns characteristic of a single layer of molecules standing with their axes approximately normal

<sup>5</sup> *Proc. I. R. E.*, April 1939.

<sup>6</sup> *Jour. S. M. P. E.*, June 1939.

<sup>7</sup> *Phys. Rev.*, April 1, 1939.

to the surface; the hydrocarbon chains of barium stearate are found to be more precisely oriented than those of stearic acid; exactly the same difference exists between unrubbed single layers of molecules of barium stearate and of stearic acid deposited by the Langmuir-Blodgett method. Thickness of rubbed films on chromium has been found, by the Blodgett optical method, to be the same as that of unrubbed single layers of molecules. *Lightly rubbed films* may be thicker than a single layer of molecules. The arrangement of barium stearate in such thicker films has been found to have been somewhat altered by the rubbing. The axes of the hydrocarbon chains still stand normal to the surface, but lateral arrangement is less regular than it is in unrubbed films of equal thickness. In the case of stearic acid, molecules left on top of the first layer after light rubbing in one direction are found to lie inclined by about  $8^\circ$  to the surface and to point outward against the rubbing direction (Fig. 7); they are arranged in crystals having a structure different from that of the film before rubbing. Such "up-set" films of stearic acid are completely removed by very light rubbing in the direction opposite to that of the original rubbing, but they are rather resistant to light rubbing in the same direction.

*Diffraction and Refraction of a Horizontally Polarized Electromagnetic Wave over a Spherical Earth.*<sup>8</sup> MARION C. GRAY. Formulas are derived for the electromagnetic field at a point on or above the surface of a spherical earth due to the presence of a vertical magnetic dipole. It is shown that the resultant field resembles that due to a vertical electric dipole above a spherical earth of low conductivity, and that in the magnetic case the values of the earth constants are of much less importance than in the electric. Curves are included showing the variation of the field with distance and with height.

*Inductive Coordination with Series Sodium Highway Lighting Circuits.*<sup>9</sup> H. E. KENT and P. W. BLYE. This paper describes the wave-shape characteristics of the sodium-vapor lamp and discusses the relative inductive influence of various series circuit arrangements in which such lamps are employed. A method is outlined by means of which the noise to be expected in an exposed telephone line may be estimated. Measures are described which may be applied in the telephone plant or in the lighting circuit to assist in the inductive coordination of the two systems. These measures need be considered only when a considerable number of lamps is involved, since noise induction is negli-

<sup>8</sup> *Phil. Mag.*, April 1939.

<sup>9</sup> *Electrical Engineering*, Transactions Section, July 1939.

gible when there are only a few lamps as, for instance, at highway intersections.

*Sound Picture Recording and Reproducing Characteristics.*<sup>10</sup> D. P. LOYE and K. F. MORGAN. In the improvement of sound motion pictures, the trend has been to make the response of all parts of the recording and reproducing circuits as nearly "flat" as possible. In some cases, however, this has resulted in unnatural sound, and therefore certain empirical practices have been adopted in the studios and theaters to make pictures sound best.

This paper describes the results of a study the purpose of which has been to evaluate the factors which affect the quality of speech as recorded and reproduced, from the vocal cords of the actor on the sound-stage to the brain of the listener in the theater. The characteristics of the various factors have been determined and combined with dialog, voice effort, and other equalizers designed to produce an overall characteristic "subjectively flat" at the brain of the theater patron. These factors, as well as others which are now in the process of being studied, are presented in this paper.

One of the most important characteristics studied is that of the change in voice quality with a change in the effort on the part of the speaker. This is described in detail in this paper. The stage and set acoustic characteristics, microphone characteristic, and dialog equalization to compensate principally for the hearing characteristic of the average theater listener, are among the factors described herein.

*A Dynamic Measurement of the Elastic, Electric and Piezoelectric Constants of Rochelle Salt.*<sup>11</sup> W. P. MASON. The elastic, electric and piezoelectric constants of Rochelle salt have been measured at low field strengths by measuring the resonant frequencies and impedance of vibrating crystals. It is shown experimentally that the resonant and anti-resonant frequencies of the crystal are both considerably below the natural mechanical resonant frequency of the crystal in disagreement with the usual derivation of the frequencies of a piezoelectric crystal. By assuming that the piezoelectric stress is proportional to the charge density on the electrodes rather than the potential gradient as usually assumed, theoretical frequencies are obtained which agree with those found experimentally. This theoretical derivation together with the measured frequencies supply values for the piezoelectric constants. The elastic constants measured dynamically show some differences from those measured statically. A large difference is

<sup>10</sup> *Jour. S. M. P. E.*, June 1939.

<sup>11</sup> *Phys. Rev.*, April 15, 1939.

found for the dynamically measured piezoelectric constants from those statically measured, which may be attributed to the finite relaxation time for the piezoelectric elements.

*A Vogad for Radio Telephone Circuits.*<sup>12</sup> S. B. WRIGHT, S. DOBA, and A. C. DICKIESON. Commercial radio telephone connections must generally be accessible to any telephone in an extensive wire system. Speech signals delivered to the radio terminals for transmission to distant points vary widely in amplitude due to the characteristics of the wire circuits and individual voices. To provide the best margin against atmospheric noise, it is usually the practice to equalize this wide range of speech amplitudes and thus drive the radio telephone transmitter at its full capacity.

Many devices have been proposed to adjust automatically the gain in a circuit to equalize speech volumes. The difficulties of providing a device which will respond properly over a wide range to the complex qualities of a speech signal have only recently been overcome to a satisfactory degree.

The voice-operated gain-adjusting device, or "vogad," described in this paper is a practical design based upon more than a year's experience with one of the most promising devices made available by earlier development effort. A trial installation of this latest vogad is now under way at Norfolk in connection with a new radio telephone system for harbor and coastal service.

<sup>12</sup> *Proc. I. R. E.*, April 1939.